ZooKeys 17: 57-88 (2009)
doi: 10.3897/zookeys.17.202
www.pensoftonline.net/zookeys

RESEARCH ARTICLE

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A new genus of Ectinosomatidae (Copepoda, Harpacticoida) from sublittoral sediments in Ubatuba, São Paulo State (Brazil), an updated key to genera and notes on *Noodtiella* Wells, 1965

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Academic editor: *Danielle Defaye* | Received 13 May 2009 | Accepted 29 June 2009 | Published 5 August 2009

urn:lsid:zoobank.org:pub:E52234CD-E65E-4F8F-95CD-04BDBDED9F39

Citation: Kihara TC, Huys R (2009) A new genus of Ectinosomatidae (Copepoda, Harpacticoida) from sublittoral sediments in Ubatuba, São Paulo State (Brazil), an updated key to genera and notes on *Noodtiella* Wells, 1965. ZooKeys 17: 57-88. doi: 10.3897/zookeys.17.202

Abstract

Both sexes of a new genus and species of Ectinosomatidae (Copepoda, Harpacticoida) from sublittoral sediments collected on the inner continental shelf in Ubatuba, São Paulo State (Brazil) are described in detail. *Chaulionyx* **gen. n.** (type species: *C. paivacarvalhoi* **sp. n.**) differs from all known genera in the presence of a conspicuous bifid spine on the prehensile P1 endopod. It can be differentiated from other genera with a prehensile endopod (*Halophytophilus* Brian, 1919; *Bradyellopsis* Brian, 1925; *Klieosoma* Hicks & Schriever, 1985) by the presence of distinctive subrectangular middorsal pores on the urosomites and the unarmed male sixth legs. The genus *Lineosoma* Wells, 1965 is recognized as a paraphyletic taxon and relegated to a junior subjective synonym of *Noodtiella* Wells, 1965. *Arenosetella pectinata* Chappuis, 1954a is removed from its floating position in *Ectinosomoides* Nicholls, 1945, transferred to the genus *Noodtiella* as *N. pectinata* **comb. n.** and considered the senior subjective synonym of *N. toukae* Mitwally & Montagna, 2001. Dichotomous keys are provided for the identification of the 18 valid species of *Noodtiella* and the 21 valid genera of the family Ectinosomatidae. *Halophytophilus aberrans* Wells & Rao, 1987 is placed *species incertae sedis* in the family.

Keywords

Harpacticoida, Ectinosomatidae, *Chaulionyx* gen. n., *Noodtiella*, *Lineosoma*, taxonomy, generic key

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Introduction

The harpacticoid family Ectinosomatidae is morphologically distinctive and arguably the most speciose group of copepods in marine meiobenthic communities. The taxonomic literature about this taxon is however, plagued by the scarcity of adequate species descriptions which poses a serious deterrent to most systematists and ecologists. In addition, the scale of variability exhibited by most described species is not well understood, males are frequently rare or completely unknown, distinctions between species and at least some genera are often debatable, and existing identification keys for the larger genera *Ectinosoma* Boeck, 1865, *Halectinosoma* Vervoort, 1962 and *Pseudobradya* Sars, 1904 are all essentially unreliable. The urgent need of revision of these genera is substantially hampered by the lack of type material and by the fact that some unverifiable descriptions undoubtedly contain important errors (Wells 2007). Recent work has demonstrated that some descriptions contain important observational errors and, consequently, some species have been attributed to the wrong genus (Clément and Moore 1995, 2000; Huys and Bodin 1997; Clément and Ólafsson 2001; Wells 2007). The recent recognition of species complexes (Clément and Moore 1995, 2000, 2007) reflects the previous ignorance of characters that have not been given the attention they deserved, such as mouthpart features and body ornamentation patterns. Hence the wide geographical distributions displayed by some ectinosomatids should not be uncritically accepted as the natural consequence of potentially transoceanic or equivalent long-distance dispersal since many of the published ectinosomatid records are probably incorrect.

The family Ectinosomatidae appears to have had a complex ecological radiation. The present day habitat utilization of most primitive genera suggests that it originated in the shallow marine environment where radiation, speciation and diversification appeared to be most successful. Most Ectinosomatidae are found in sublittoral marine sediments ranging from coarse sands to flocculent muds but literature data indicate that several independent freshwater incursions occurred during the evolutionary history of the family. Within the speciose, primarily marine genus *Halectinosoma*, at least four species have colonized freshwater habitats in Laurasia: *H. abrau* (Krićagin, 1878), *H. concinnum* (Akatova, 1935), *H. japonicum* (Miura, 1964) and *H. uniarticulatum* Borutzky, 1972. The genus *Pseudectinosoma* Kunz, 1935 appears to have descended from a coastal brackish water ancestor and primarily inhabits karstic springs, bores, wells, phreatic lakes and hyporheic habitats in Europe and Australia (Galassi et al. 1999; Karanovic 2006). A third freshwater incursion was reported by Karanovic and Pesce (2001) who described *Rangabradya indica* from subterranean waters in India. Various other ectinosomatid species have been recorded in low salinity habitats but at least for some of them the generic placement needs re-evaluation (e.g. Miura 1962, 1964; Štěrba 1968; Bruno and Cottarelli 1999; Bruno et al. 2003).

Although the majority of ectinosomatids have been described from the continental shelf and the intertidal zone, various species of *Halectinosoma*, *Bradya* Boeck, 1873 and *Parabradya* Lang, 1944 have secondarily radiated into the deep sea (Bodin 1968;

Seifried et al. 2007) and recent research (Gheerardyn et al. 2008) suggests that many other genera have achieved the same habitat shift. Others, such as species of *Arenosetella* Wilson, 1932, *Glabrotelson* Huys, 2009 and *Noodtiella* Wells, 1965 are found on the other end of the bathymetric spectrum, being frequently the only harpacticoids occurring in the infra- and supralittoral zones of sandy beaches (Mielke 1976). In beaches and sandy sublittoral habitats various genera have colonized the interstitial environment, either by adopting a cylindrical body shape (*Arenosetella*, *Ectinosomoides* Nicholls, 1945, *Glabrotelson*, *Lineosoma* Wells, 1965, *Noodtiella*, *Oikopus* Wells, 1967) or by simple miniaturization of the ancestral fusiform body (*Sigmatidium* Giesbrecht, 1881). Finally, some ectinosomatid lineages are no longer associated with the ancestral benthic habitat but have moved into the open pelagic or have abandoned their essentially free-living lifestyle. The holoplanktonic genus *Microsetella* Brady & Robertson, 1873 is known to attach and feed on discarded and occupied larvacean houses (Appendicularia) (Alldredge 1972; Ohtsuka et al. 1993) while other taxa have entered into associations with invertebrates. Examples of the latter include *Peltobradya bryozoophila* Médioni & Soyer, 1968, which appears to be associated with the bryozoan *Schizomavella linearis* (Hassall, 1841) (Médioni and Soyer 1968), and an as yet undescribed genus which was found in the mucus coat surrounding the polychaete host *Hydroides elegans* (Haswell, 1883) (Huys unpubl.).

Excellent recent studies by Mielke (1979, 1981, 1986, 1987a–b) have contributed substantially to our knowledge of Central and South American Ectinosomatidae. However, the fauna along the vast Brazilian coastline remains poorly known (Reid 1998). Jakobi (1954) described three species of *Pseudobradya* and two species of *Ectinosoma* from Paraná State. Unfortunately, his descriptions are essentially inadequate and Lang (1965) suggested ranking all of them as *species inquirendae* while Wells (2007) listed them as *species incertae sedis*. The species described by Jakobi and Nogueira (1960) as *Ectinosoma couceiroi* is a likely synonym of *E. dentatum* Steuer, 1940 (Lang 1965: 17) and has thus far been recorded only from the Lagoa de Conceição in Santa Catarina State. Rouch (1962) described two new species, *Noodtiella problematica* and *Halectinosoma arenicola*, from sandy beaches in Pernambuco State and listed the first South American record of the allegedly cosmopolitan *Arenosetella germanica* Kunz, 1937. During the course of a meiofaunal survey off Ubatuba (São Paulo State) we discovered several new species of the Ectinosomatidae. One of these represented the most abundant harpacticoid copepod in the area and is described here as a representative of an as yet unknown genus, raising the number of valid genera in the family to twenty-one (Seifried et al. 2007; Wells 2007; Huys 2009).

Material and methods

Sediment samples were obtained during an ecological study of the meiofaunal diversity along the northern coast of São Paulo State as part of the interdisciplinary project "Utilização Racional do Ecossistema Costeiro da Região Tropical Brasileira: Estado

de São Paulo" conducted by the Departamento de Oceanografia Biológica – Instituto Oceanográfico da Universidade de São Paulo (IOUSP). Samples were collected at 12 stations along the inner continental shelf (15-53 m depth) between São Sebastião Island and Ubatumirim inlet, Ubatuba, in March and August, 1989. Description of the sampling methodology and physical and chemical analysis is given by Corbisier (1993). Coordinates and environmental parameters of the stations where the new genus occurred are compiled in Table 1.

Before dissection, the habitus was drawn from whole specimens temporarily mounted in glycerine. Adhesive plastic discs were used to support the coverslip in temporary mounts. Specimens were dissected in lactic acid and the dissected parts were mounted on slides in glycerine. Preparations were sealed with transparent nail varnish. All drawings were prepared using a camera lucida on a Zeiss Axioskop 2 Plus differential interference contrast microscope. Total body length was measured from the anterior margin of the rostrum to the posterior margin of the caudal rami. The descriptive terminology is adopted from Huys et al. (1996). Abbreviations used in the text are: ae, for aesthetasc; P1–P6, for swimming legs 1-6; exp, enp and benp for exopod, endopod and baseoendopod, respectively; exp (enp)-1 (-2, -3) denotes the proximal (middle, distal) segments of a ramus. The term 'acrothek' denotes the trifid setal structure found on the apical margin of the distal antennulary segment (Huys and Iliffe 1998). Type material is deposited in the collections of the Museu de Zoologia, Universidade de São Paulo (MZUSP) and the Natural History Museum, London (NHM).

Three females and three males were prepared for scanning electron microscopy (SEM). Specimens were dehydrated through a series of graded acetone, critical-point

Table 1. Coordinates and environmental parameters of sampling sites where *Chaulionyx paivacarvalhoi* gen. et sp. n. was recorded during the interdisciplinary project "Utilização Racional do Ecossistema Costeiro da Região Tropical Brasileira: Estado de São Paulo" (Departamento de Oceanografia Biológica – IOUSP). Stations were sampled across the inner continental shelf of São Paulo State between São Sebastião Island and Ubatumirim inlet, Ubatuba during March (V stations) and August 1989 (I stations). Lat. = latitude, Long. = longitude; Temp. = temperature; MZ = grain size; GS = sorting; C_{org} = organic carbon.

Station	Lat.	Long.	Depth	Temp.	MZ	GS	Sand	Silt	Clay	C_{org}	$CaCO_3$
	(S)	(W)	(m)	(°C)	(Ø)	(φ)	(%)	(%)	(%)	(%)	(%)
5V	23° 40.8'	44° 46.2'	53	15.3	4.61	1.86	63.10	25.45	11.45	1.00	17.00
7V	23° 31.2'	44° 51.0'	44	15.3	1.02	0.92	98.64	0.39	0.00	0.03	8.70
16V	23° 45.5'	44° 56.4'	52	15.8	4.94	1.63	46.14	43.84	10.02	1.07	16.70
17V	23° 41.4'	44° 58.8'	44	15.6	3.56	0.83	83.73	13.56	2.71	0.57	20.5
27V	23° 46.2'	45° 07.8'	34	15.6	3.63	0.85	87.23	8.12	4.64	0.42	9.70
7I	23° 31.2'	44° 51.1'	44	18.6	3.44	0.88	89.35	0.63	1.79	0.28	27.7
16I	23° 45.7'	44° 56.3'	52	17.8	4.47	1.67	64.93	25.82	9.25	4.48	20.0
17I	23° 41.4'	44° 58.9'	44	18.1	5.04	2.53	45.60	34.46	19.94	1.73	30.6
18I	23° 37.2'	45° 01.3'	41	18.3	3.52	0.77	87.59	10.01	2.40	0.67	17.10
26I	23° 50.5'	45° 05.5'	45	20.5	4.15	1.18	72.42	21.23	6.36	1.26	15.00
27I	23° 46.3'	45° 07.7'	39	20.4	3.65	0.79	85.71	10.39	3.90	0.29	15.20

dried, mounted on stubs, sputter-coated with palladium and observed using a Philips XL 30 Field Emission Scanning Electron microscope.

Results

Order HARPACTICOIDA Sars, 1903
Family ECTINOSOMATIDAE Sars, 1903

***Chaulionyx* gen. n.**
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Diagnosis. Ectinosomatidae. Small-sized. Body fusiform, greatest width measured at posterior margin of cephalothorax; body somites strongly chitinized; hyaline frill of cephalic shield and somites bearing P2–P4 plain, that of other somites minutely serrate; no distinct surface ornamentation except for anterodorsal spinule rows on all body somites, ventral spinule rows on abdominal somites and large middorsal pores. Pseudoperculum weakly developed. Sexual dimorphism in antennule, P1, P5, P6, genital segmentation, abdominal ornamentation and caudal ramus.

Rostrum large, hyaline, broadly rounded, not defined at base. Antennule 5-segmented in female, 7-segmented in male with geniculation between segments 5 and 6. Antenna with 3-segmented exopod (formula 0-1-2); distal endopod segment with 2 lateral and 5 apical elements. Labrum with frontal spinous projection. Mandible with small gnathobase and biramous palp; basis with 3 setae, exopod minute with 3 setae, endopod with 3 lateral and 7 apical elements. Maxillule with well developed arthrite; coxa represented by a single seta; exopod bisetose with the lateral seta typically outwardly reflexed; basis and endopod fused, with 10 setae in total. Maxilla prehensile, robust; syncoxa with 3 endites (formula 4-1-3); allobasis with 3 lateral and 1 apical setae; endopod 2-segmented (ancestral segments 2-3 fused). Maxilliped stenopodial, 3-segmented, slender; syncoxa with 1 seta; endopod with 1 lateral and 3 terminal setae.

P1 with an inner and an outer seta on the basis; exopod 3-segmented; endopod prehensile, 2-segmented, enp-2 with bifid outer claw. P2–P4 with outer seta on basis; rami 3-segmented; inner seta of enp-2 distinctly short. Armature formula:

	Exopod	Endopod
P1	0.1.122	1.321
P2	1.1.222	1.1.221
P3	1.1.222	1.1.221
P4	1.1.322	1.1.221

P5 of both sexes with separate exopod and baseoendopod; exopod with 1 surface and 3 marginal setae; endopodal lobe with 2 spines/setae.

Female gonopores fused forming a median genital slit, covered by the pair of P6 each bearing 1 long seta; midventral copulatory pore small.

Male P6 asymmetrical, unarmed; functional member represented by small operculum, other member fused to genital somite.

Caudal ramus short, with 7 setae; setae IV–V basally fused, without fracture planes.

Type and only species. *Chaulionyx paivacarvalhoi* sp. n.

Etymology. The generic name is derived from the Greek *chaulios* (outstanding, prominent) and *onyx* (nail, claw), and refers to the modified, claw-like, bifid outer spine on the P1 endopod. Gender: feminine.

Chaulionyx paivacarvalhoi sp. n.

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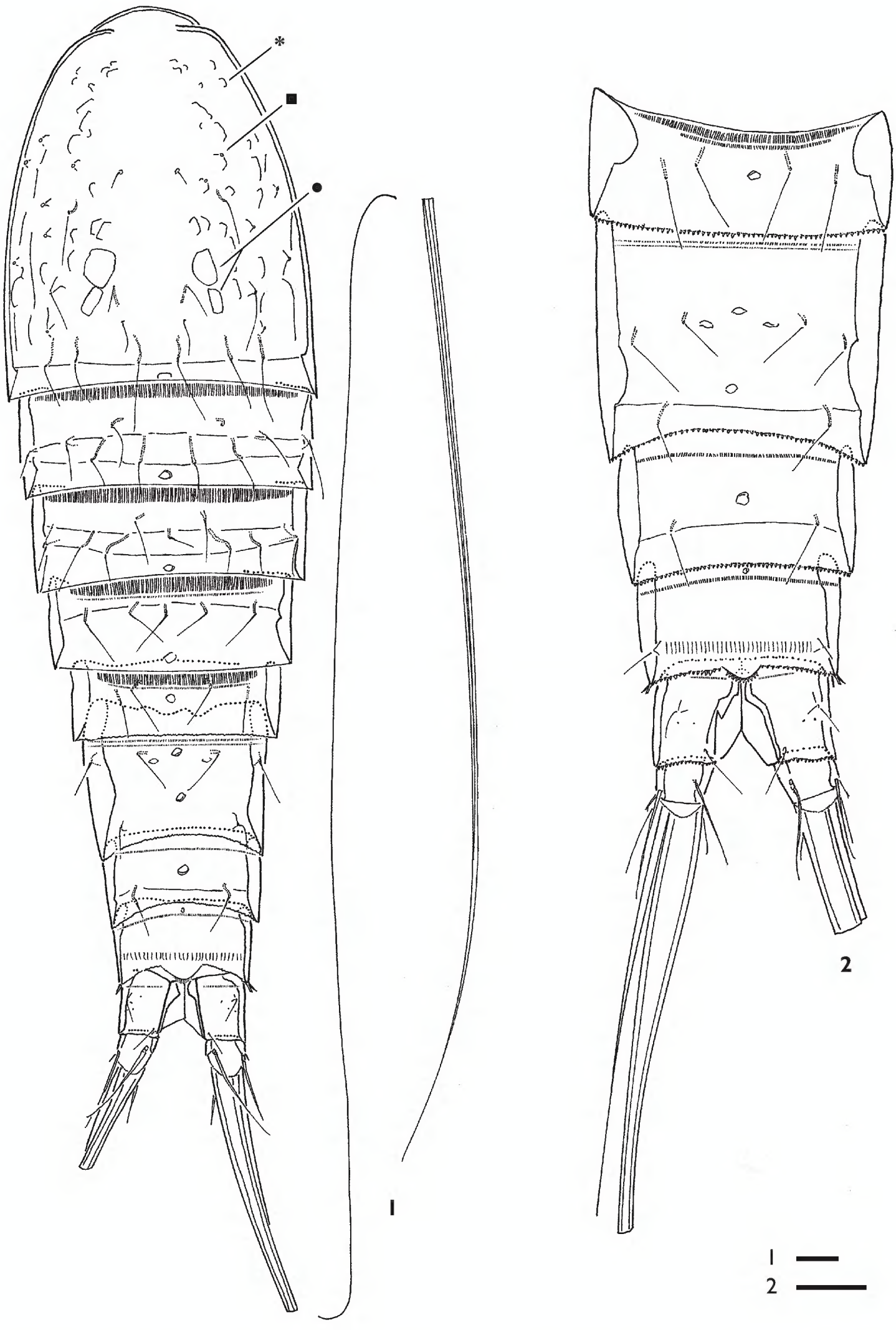
Figs 1-37

Type locality. Brazil, northern coast of São Paulo State, Ubatuba (23° 41.4' S, 44° 58.8' W), 44 m depth (station 17V in Table 1).

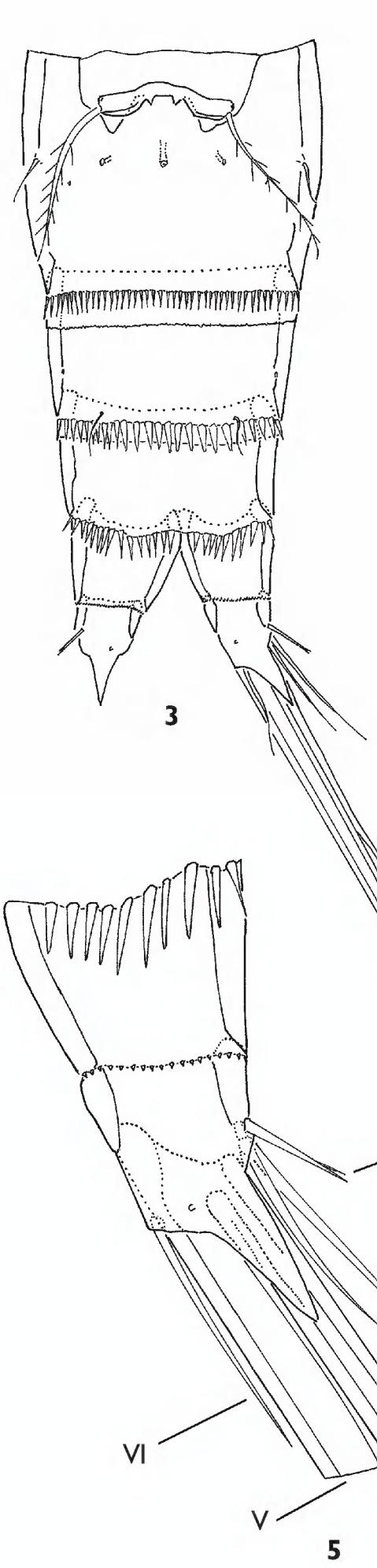
Material examined. Holotype female in ethanol (reg. no. MZUSP 16467). Undissected paratypes (in ethanol) deposited in MZUSP (reg. nos 16468, 19063-19065) are 1 female and 1 male from station 17V; 3 females and 1 male from station 16V, 2 males from station 16I, 1 female and 1 male from station 17I. Additional undissected paratypes (in ethanol) deposited in NHM are 2 males from station 17V (reg. nos 2009.1-2), 3 females from station 27V (reg. nos 2009.3-5) and 1 male from station 27I (reg. no 2009.6). Dissected paratypes and other material examined are retained in the personal collection of C.E.F. da Rocha (Departamento de Zoologia, Instituto de Biociências, Universidade de São Paulo). All material collected by T. Corbisier.

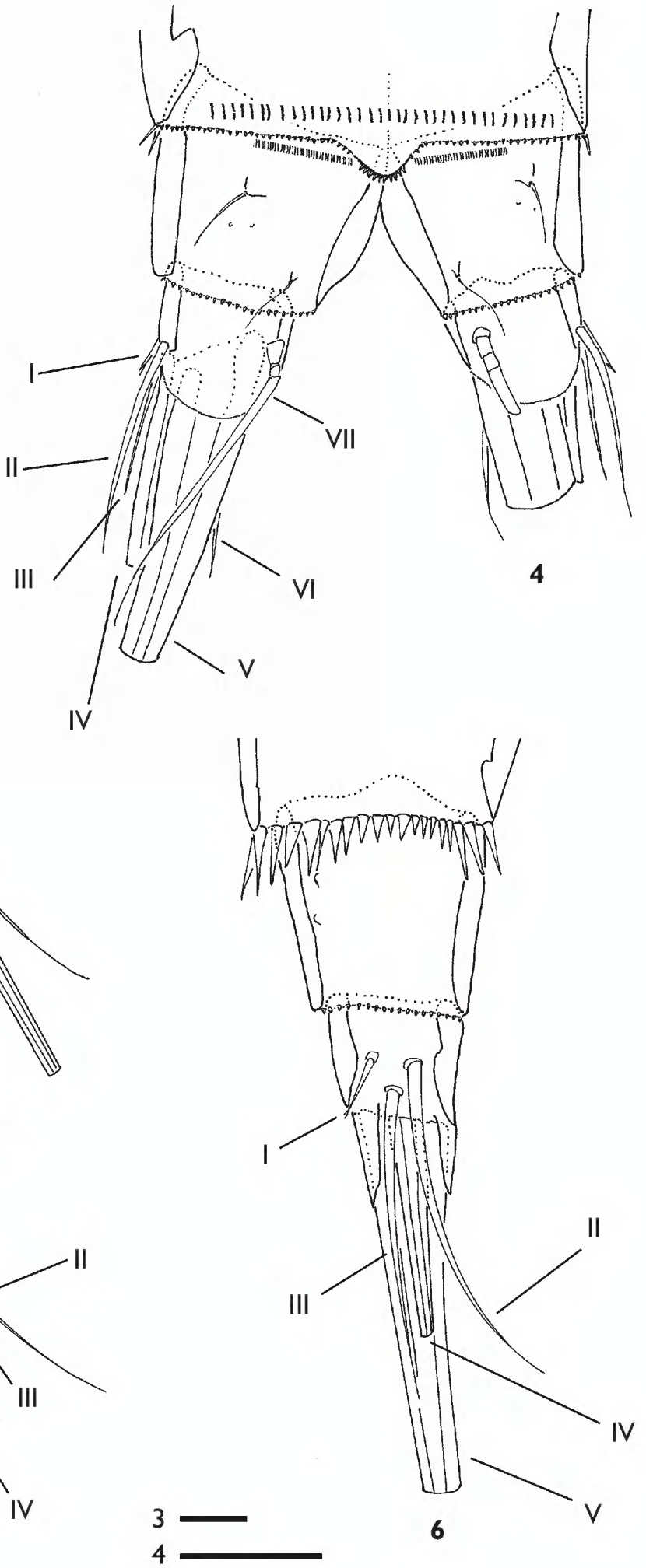
Description. FEMALE (Figs 1-21, 27-35). Body length 260-290 µm (n = 4; mean = 275 µm). Body (Fig. 1) fusiform, maximum width measured at posterior margin of cephalic shield; body somites gradually tapering posteriorly. Cephalic shield with minute integumental pits and numerous pores; paired chitinous patches present dorsally in posterior half (for examples of these integumental structures see labelling in Fig. 1 and accompanying legend). Body somites with thickly chitinized cuticle; pedigerous somites and second abdominal somite with large middorsal pore; genital double-somite with 2 pores. Sensillae long and fine, distributed as illustrated in Fig. 1. Hyaline frill of cephalic shield and somites bearing P2–P4 plain, partially concealing fine spinular rows located in anterior half of succeeding somite (Fig. 1); frills of urosomites minutely denticulate (Figs 1-2, 30-31).

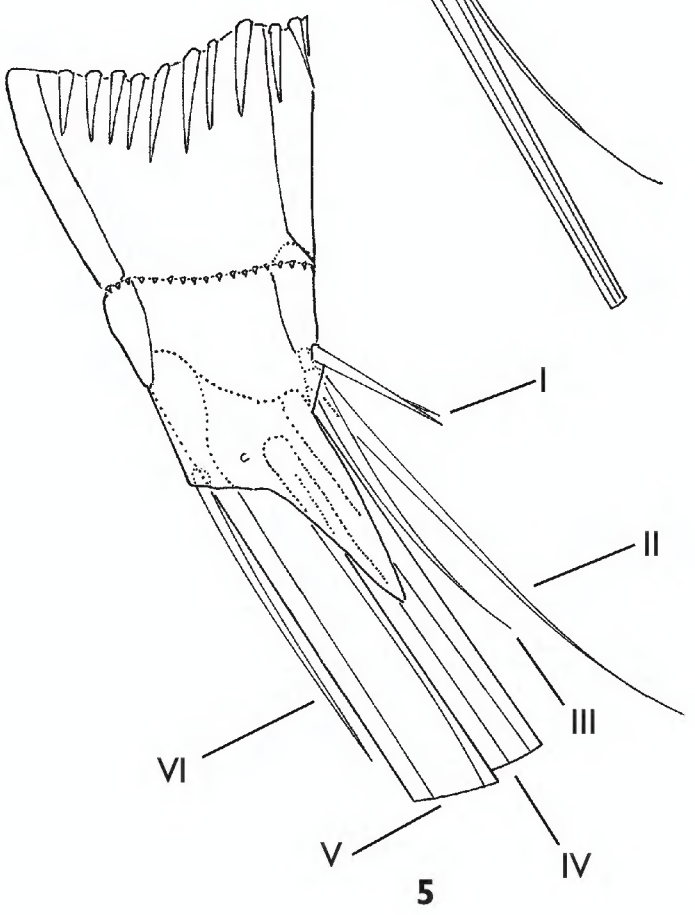
Genital and first abdominal somites fused forming double-somite (Figs 1-3, 21); slightly longer than broad; posterior margin with continuous spinular row; original segmentation marked by sensilla, paired dorsal chitinous patches and a middorsal pore (Fig. 2). Second and third abdominal somites with a continuous row of coarse spinules around ventral posterior margin (Fig. 3). Penultimate somite with a small pseudoper-



Figures 1-2. *Chaulionyx paivacarvalhoi* sp. n. ♀: **1** habitus, dorsal [* = integumental pit; ■ = pore ; ● = chitinous patch **2** urosome, dorsal. Scale bars = 10 µm.







Figures 3-6. *Chaulionyx paivacarvalhoi* gen. et sp. n. ♀: **3** urosome, ventral [segment bearing P5 omitted] **4** caudal rami, dorsal **5** left caudal ramus, ventral **6** left caudal ramus, lateral. Scale bars = 10 μm.

culum (Figs 1-2, 30), dorsal surface and distal margin with rows of spinules (Figs 30, 32). Anal somite (Figs 1-4, 30) medially cleft; dorsal surface with paired anterior rows of minute spinules and pairs of sensilla and pores (Fig. 4); distal margin with small spinules (Fig. 33); anal operculum absent.

Caudal rami (Figs 4-6) about as long as wide, with 7 naked setae; bases of terminal setae covered by rounded membranous serrate extension dorsally (Figs 4, 30, 34) and an acuminate lappet ventrally (Fig. 5). Seta I minute, with bifid apex. Setae IV–V fused basally, without fracture planes. Seta V longest and swollen in proximal half. Seta VII tri-articulate at base.

Rostrum large (Figs 7, 27), ventrally deflected; broadly rounded, quadrangular; not defined at base but original demarcation marked by membranous areas bilaterally (Fig. 27); no sensilla discernible.

Antennule (Fig. 8) short, 5-segmented. Segment 1 with pinnate seta; segment 3 with conspicuous aesthetasc; distal segment long, with apical acrothek consisting of aesthetasc and 2 slender setae. Armature formula: 1-[1 pinnate], 2-[7], 3-[6 + (1 + ae), 4-[1], 5-[5 + acrothek].

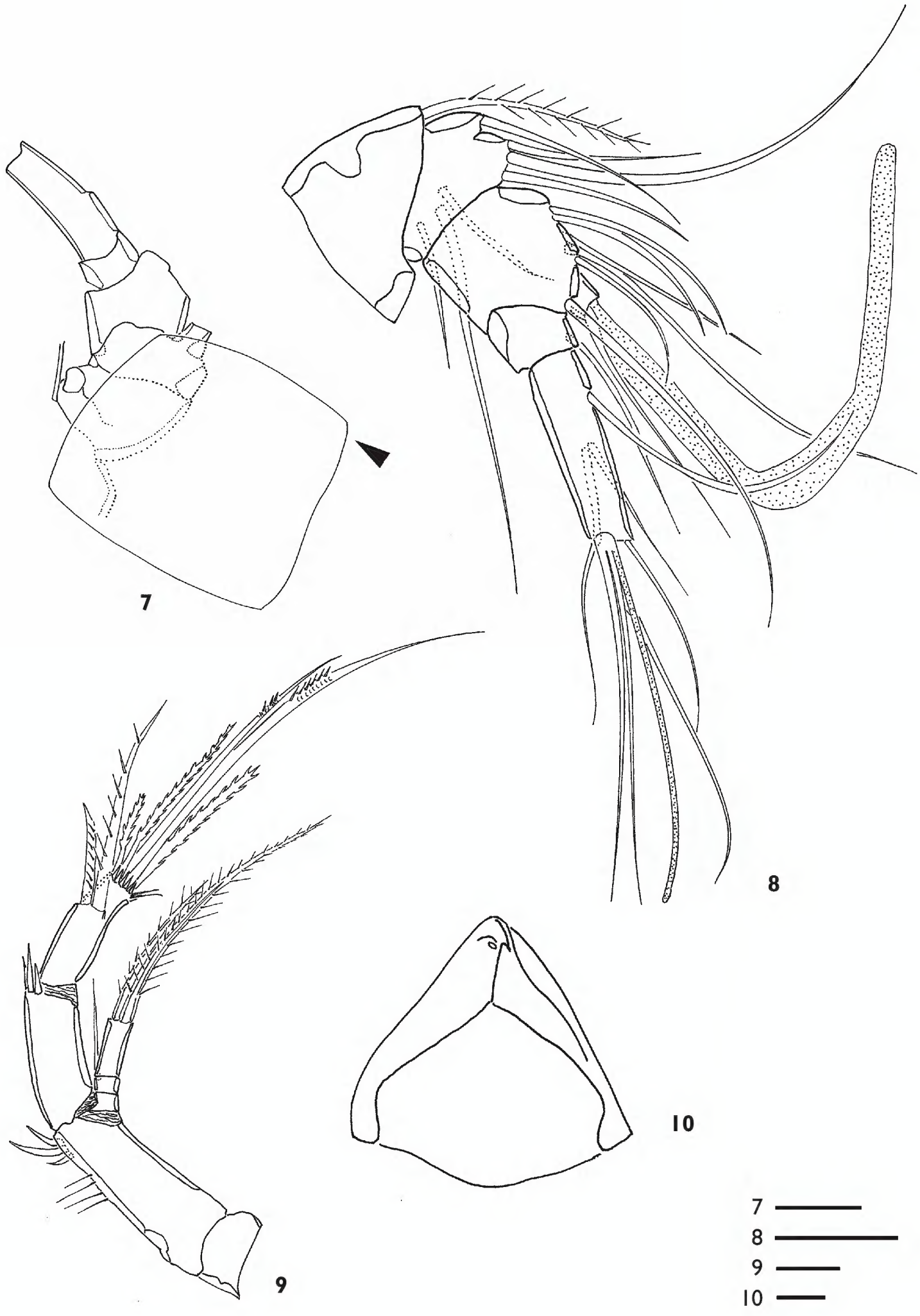
Antenna (Fig. 9) consisting of coxa, basis, 2-segmented endopod and 3-segmented exopod. Coxa small, indistinctly demarcated at base, without ornamentation. Basis unarmed; with some fine spinules along abexopodal margin and coarse spinules set near outer distal corner. Proximal endopod segment with a few coarse spinules near outer distal corner. Distal endopod segment with 2 unipinnate setae laterally; distal margin with spinule row and 5 elements, 2 of which are geniculate, others bipinnate. Exopod with small proximal and middle segments and elongate apical segment; exp-1 unarmed, exp-2 with short naked seta, exp-3 with 2 pinnate apical setae.

Labrum (Figs 10, 28) well developed, with frontal curved spinous projection bearing large anterior pore.

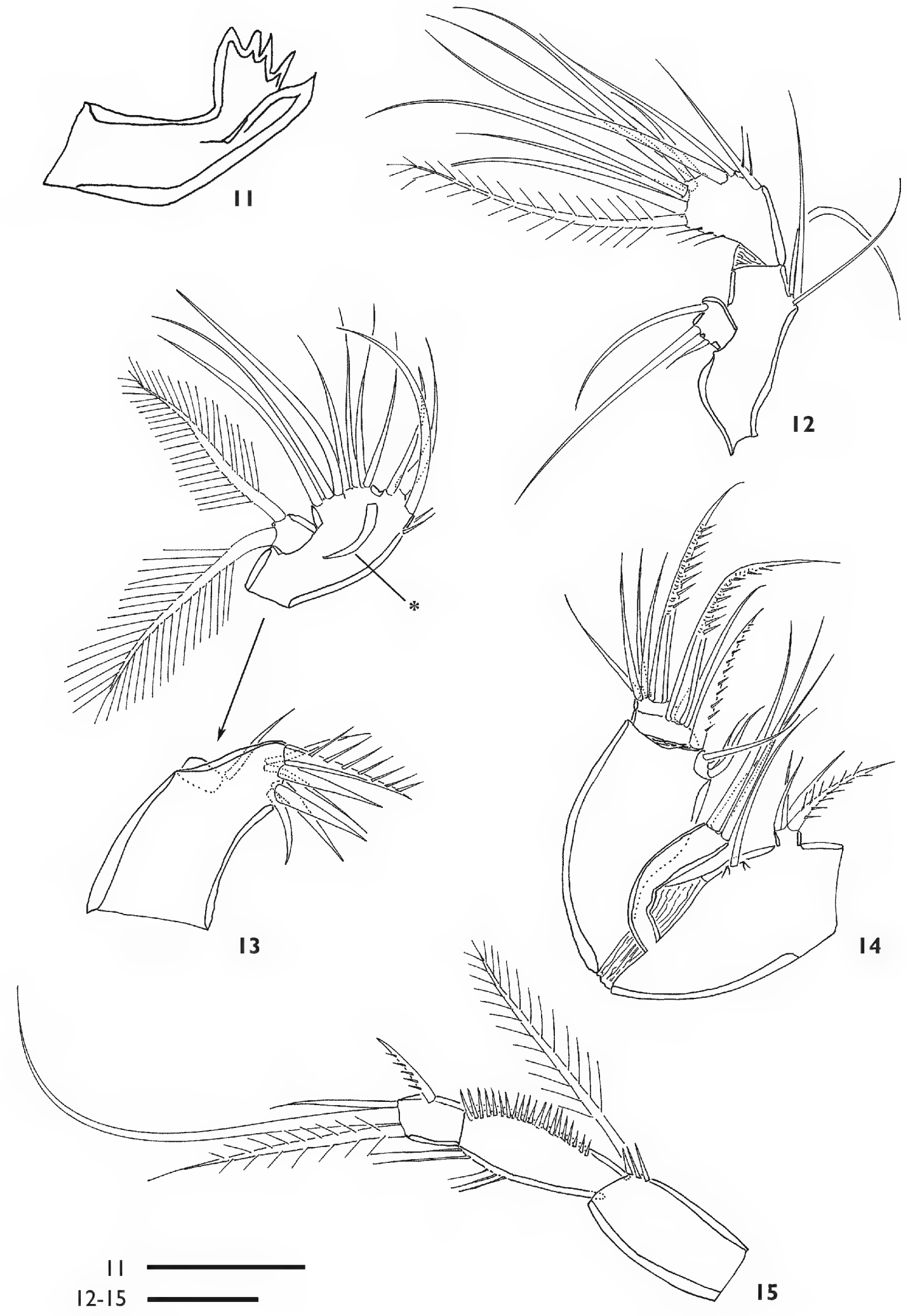
Mandible with small coxa (Fig. 11) and biramous palp (Fig. 12). Gnathobase reduced, with chitinized dorsal tooth and number of hyaline pointed projections. Basis elongate, with 3 lateral setae. Exopod small, 1-segmented, with 3 naked setae, outer one reduced. Endopod 1-segmented, with row of fine spinules along outer margin; armature consisting of 1 sparsely pinnate and 2 naked setae laterally and 1 bipinnate and 6 naked setae apically.

Maxillule (Fig.13) with fused praecoxa and coxa. Praecoxa with well developed arthrite bearing 4 spines and 1 seta around distal margin and 2 small setae on anterior surface; distalmost marginal spine with long spinules. Coxa represented by small seta on anterior surface near articulation with palp. Endopod incorporated into basis forming elongate segment; proximal basal endite a small protuberance bearing 3 setae; elements of distal basal endite (4) and endopod (3) forming group of 7 setae arranged around the distal margin; with cuticular reinforcement (indicated by asterisk in Fig. 13) on posterior surface; distal medial margin with characteristic spinules. Exopod a free small segment; with 1 apical and 1 backwardly directed plumose seta.

Maxilla (Fig. 14) prehensile, comprising syncoxa, allobasis and 2-segmented endopod with syncoxa and allobasis directed at a right angle. Syncoxa with 3 endites; proxi-



Figures 7-10. *Chaulionyx paivacarvalhoi* gen. et sp. n. ♀: **7** rostrum (arrowed) and left antennule (armature omitted), dorsal **8** right antennule, dorsal **9** antenna **10** labrum. Scale bars = 10 μm.



Figures 11-15. *Chaulionyx paivacarvalhoi* gen. et sp. n. ♀: **11** mandibular gnathobase **12** mandibular palp **13** maxillule [asterisk indicating cuticular reinforcement] **14** maxilla **15** maxilliped. Scale bars = 10 µm.

mal endite small, with 1 bipinnate and 3 naked setae; middle endite rudimentary, with 1 long naked seta; distal endite cylindrical and recurved, located in membranous area at syncoxa-allobasis joint, with 3 long naked setae. Allobasis robust, expanding in distal half; armed with 3 setae (2 small) near inner distal corner (derived from basis) and 1 strong pinnate seta on posterior surface (derived from incorporated endopod segment). Endopod with 1 geniculate pinnate claw and 1 naked seta on enp-1; enp-2 (representing fused middle and distal segments) with 1 geniculate pinnate claw and 4 naked setae.

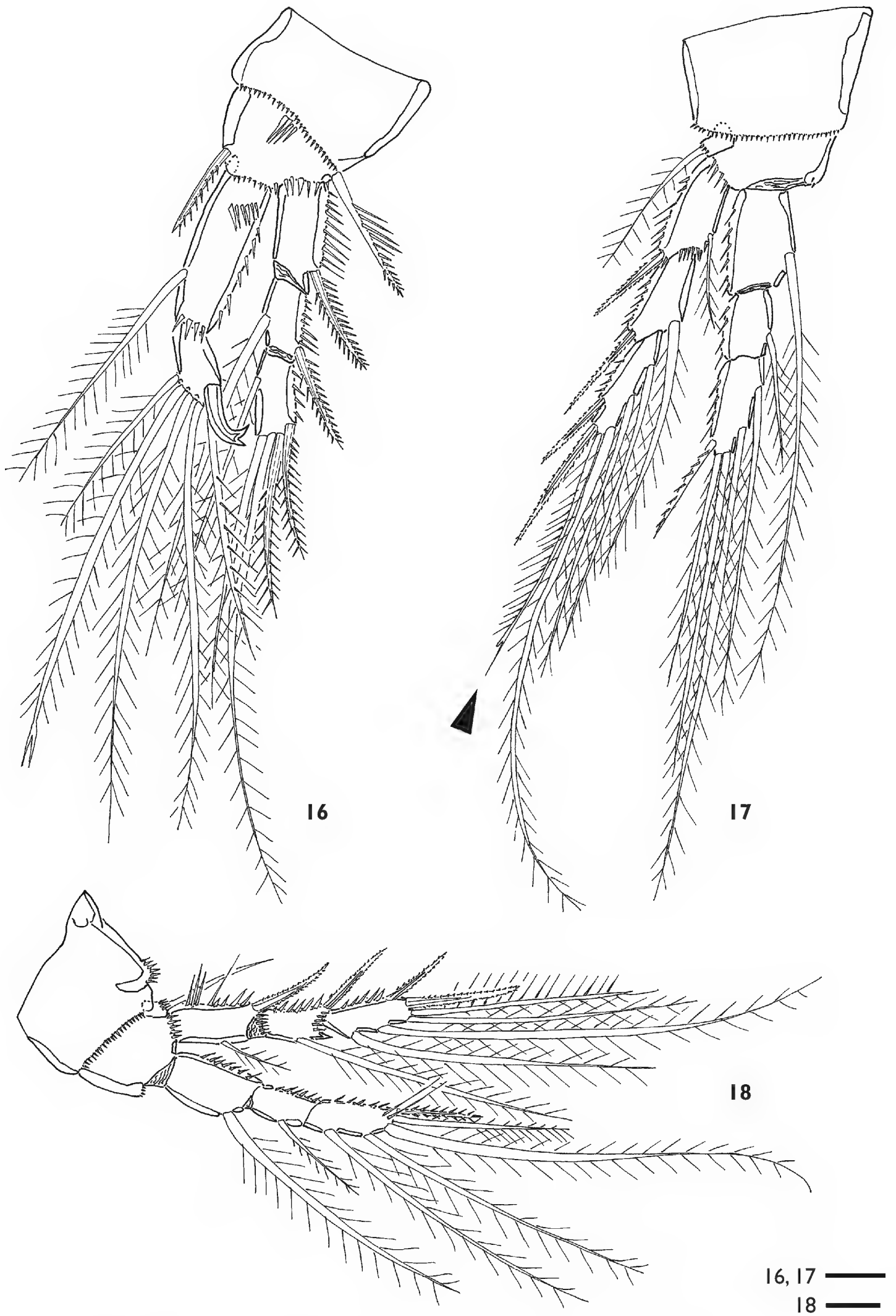
Maxilliped (Fig. 15) stenopodial and slender, comprising syncoxa, basis and 1-segmented endopod. Syncoxa with long pinnate seta and few spinules near distal corner. Basis unarmed; with long setules along outer margin and fine spinules along inner margin. Endopod with 1 short pinnate seta laterally and 1 short plus 2 longer (1 plumose) setae apically.

P1 (Fig. 16). Coxa with row of minute spinules along distal margin. Basis with rows of spinules on anterior surface and near insertion of exopod as illustrated; outer seta long, bipinnate and spiniform; inner spine unipinnate with spinules along outer margin. Exopod 3-segmented; with rows of spinules along outer margins; outer spines strong and bipinnate; exp-1 without inner seta; exp-2 with 1 inner plumose seta; exp-3 with 1 inner plumose seta, 2 plumose distal setae and 2 bipinnate outer spines. Endopod 2-segmented, prehensile; enp-1 elongate, with rows of spinules on anterior surface and along outer and distal margins, and 1 plumose inner seta inserted in distal third of segment; enp-2 with 3 plumose inner setae (middle one with bifid apex), 2 plumose distal setae, and 1 curved strong spine with bifid tip (Fig. 29).

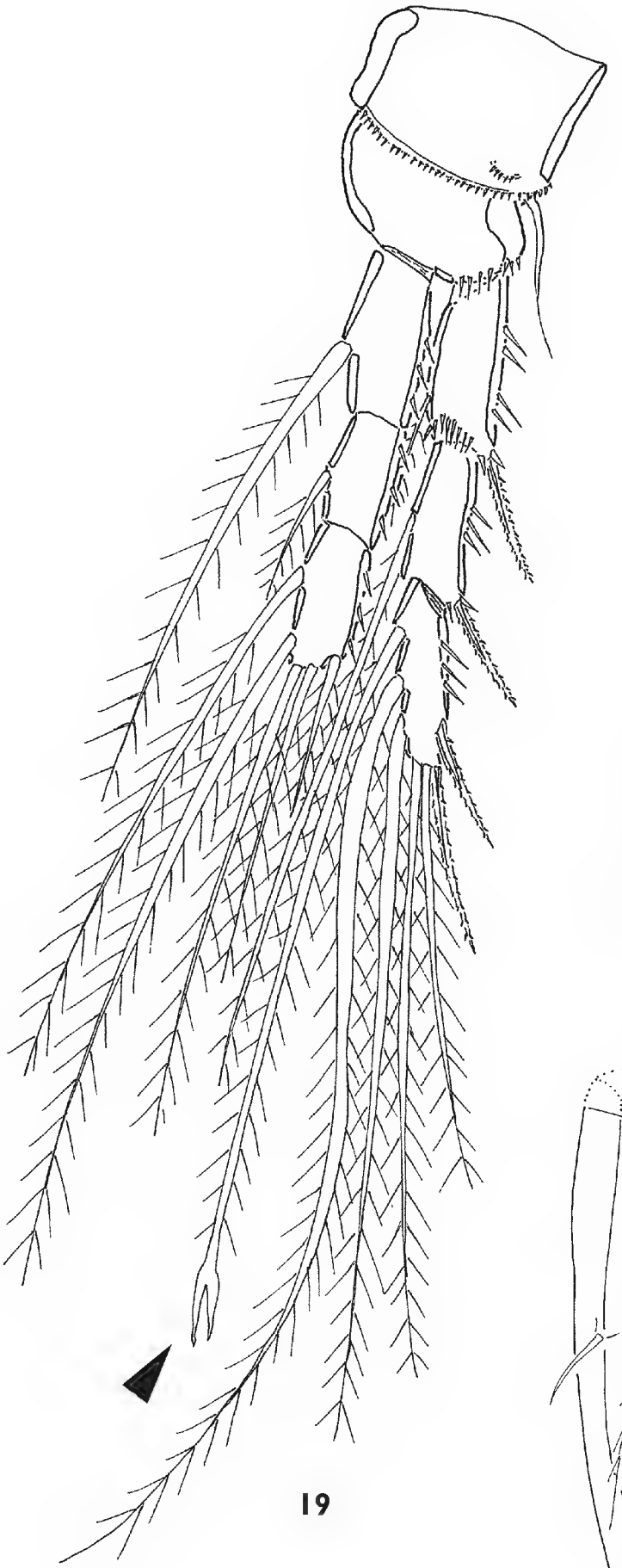
P2–P4 (Figs 17-19). Coxa with small spinules along distal margin. Basis with rows of spinules at base of exopod and around outer seta; outer seta plumose (P2) or naked (P3–P4). Exopod 3-segmented; with rows of spinules along outer margins; outer spines strong and bipinnate. Exp-1 with 1 reduced plumose inner seta; exp-2 with 1 plumose inner seta; exp-3 with 2 bipinnate outer spines, 2 plumose distal setae and 2 (P2–P3) or 3 (P4) plumose inner setae. P2 exp-3 outer distal seta plumose along outer margin and with apical flagellum (arrowed in Fig. 17). P4 exp-3 proximal inner seta with bifid apex; middle inner seta extremely well developed. Endopod 3-segmented; with rows of spinules along outer margins. Enp-1 with 1 plumose inner seta; enp-2 with 1 reduced plumose inner seta; enp-3 with 4 plumose setae (2 inner and 2 distal) and 1 bipinnate outer spine (P2–P3) or 1 plumose outer seta (P4). Armature formula of swimming legs as for genus.

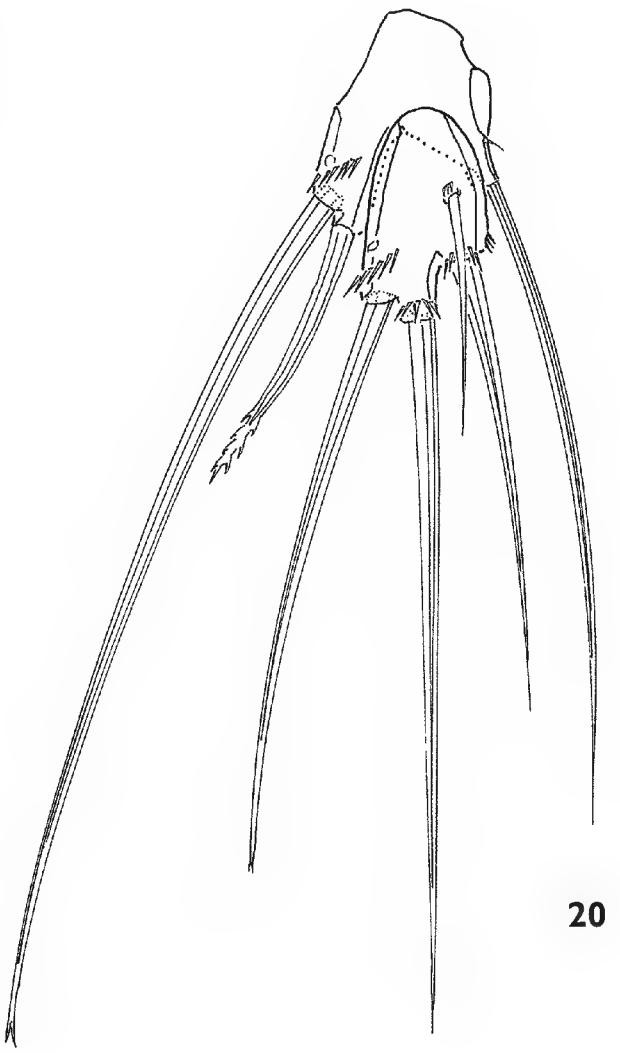
P5 (Figs 20, 35). Baseoendopod outer expansion with 1 naked seta. Endopodal lobe with spinular row and small pore on anterior surface; with 2 naked setae, inner one very long (3.2 times longer than outer one) and with bifid apex, outer one with serrate apex. Exopod with 1 pore near distal inner margin and various spinule rows as figured; anterior surface with 1 naked seta; with 3 marginal setae, innermost one with bifid apex.

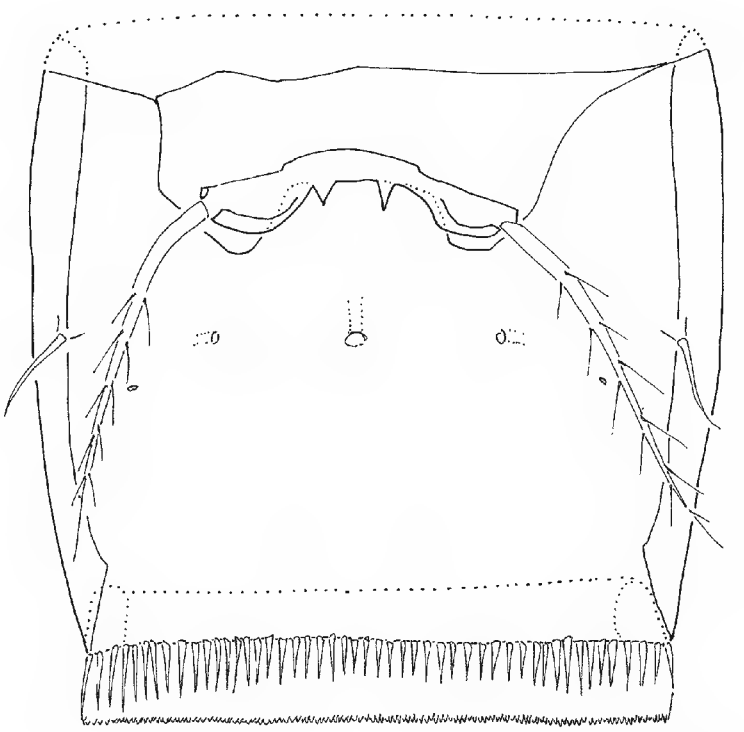
Genital field (Figs 3, 21) with relatively small midventral copulatory pore. Sixth pair of legs (Fig. 21) vestigial, fused medially forming a common plate that covers paired genital apertures (or median slit); each P6 with 1 plumose seta. Egg-sac single.

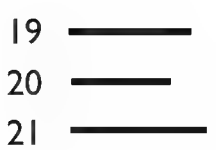


Figures 16-18. *Chaulionyx paivacarvalhoi* gen. et sp. n. ♀: **16** P1, anterior; **17** P2, anterior [seta with apical flagellum arrowed] **18** P3, anterior. Scale bars = 10 µm.

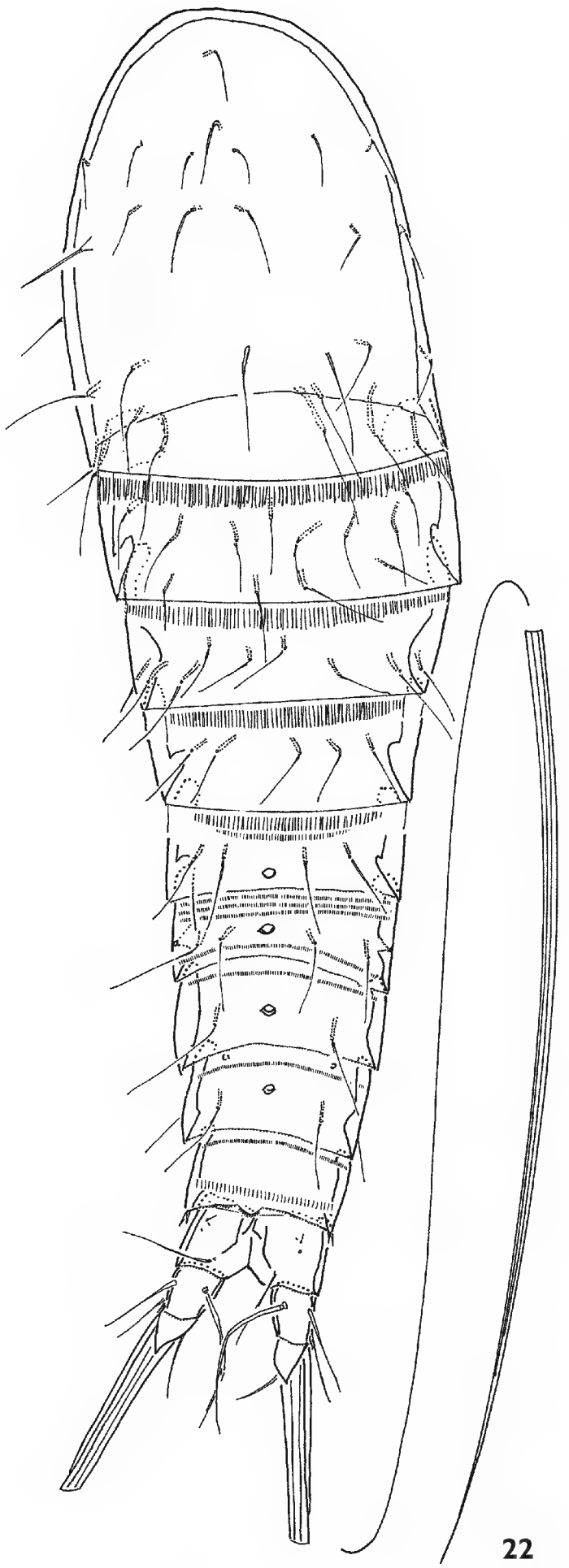


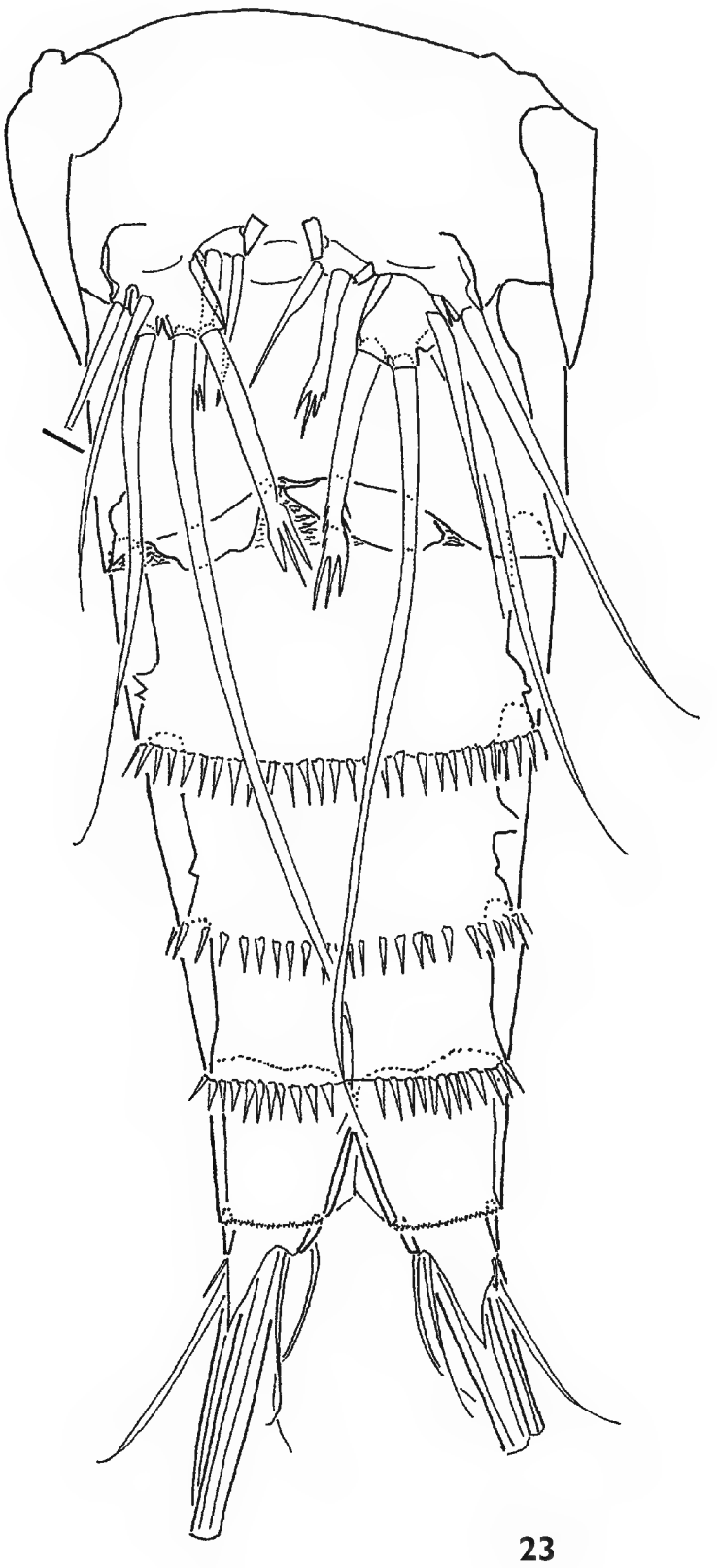




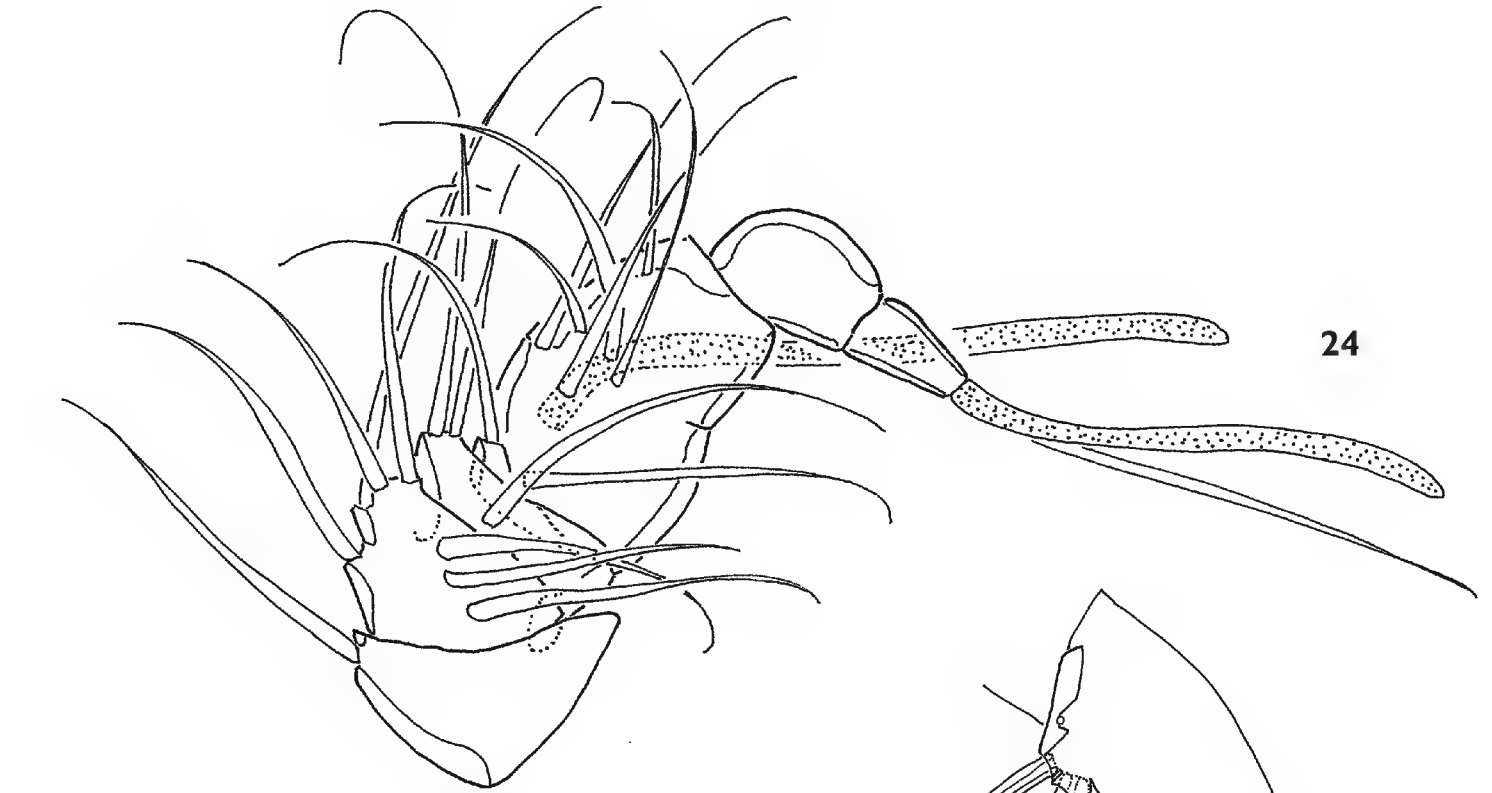


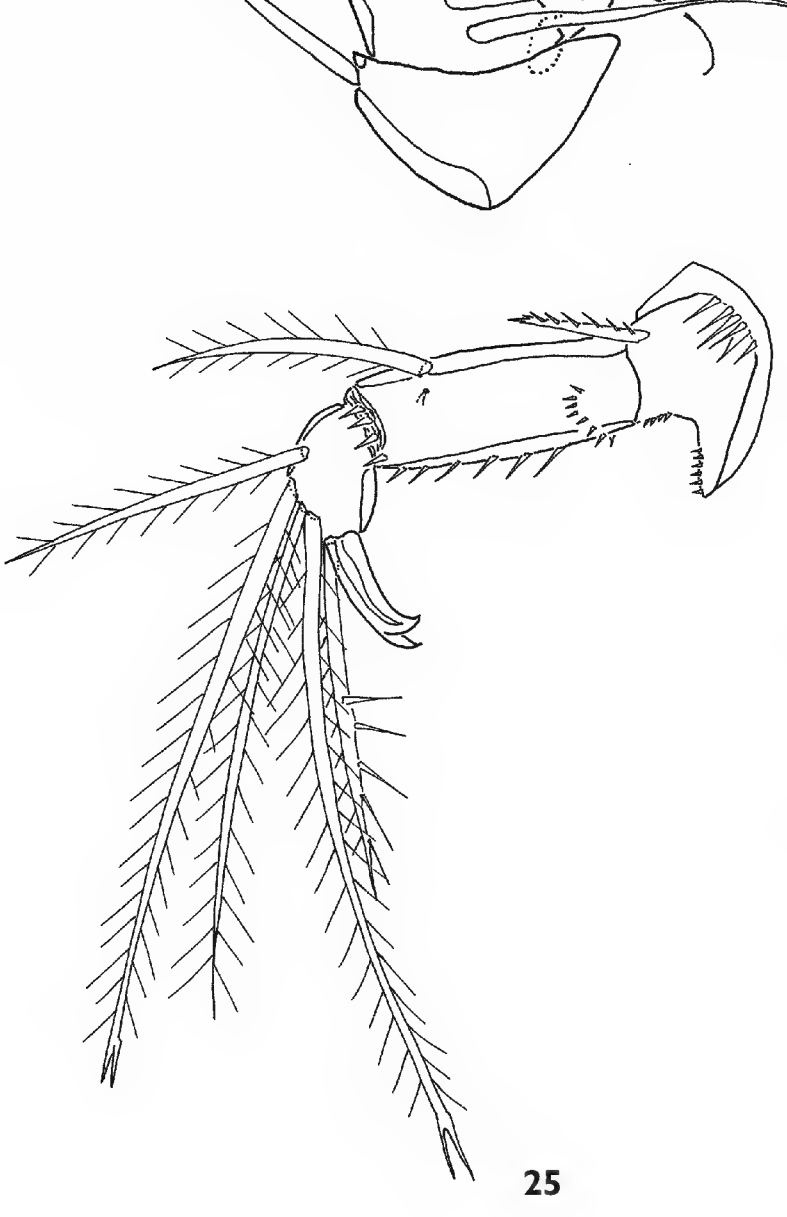
Figures 19-21. *Chaulionyx paivacarvalhoi* gen. et sp. n. ♀: **19** P4, anterior [seta with bifid apex arrowed] **20** P5, anterior **21** genital double-somite. Scale bars = 10 μm.

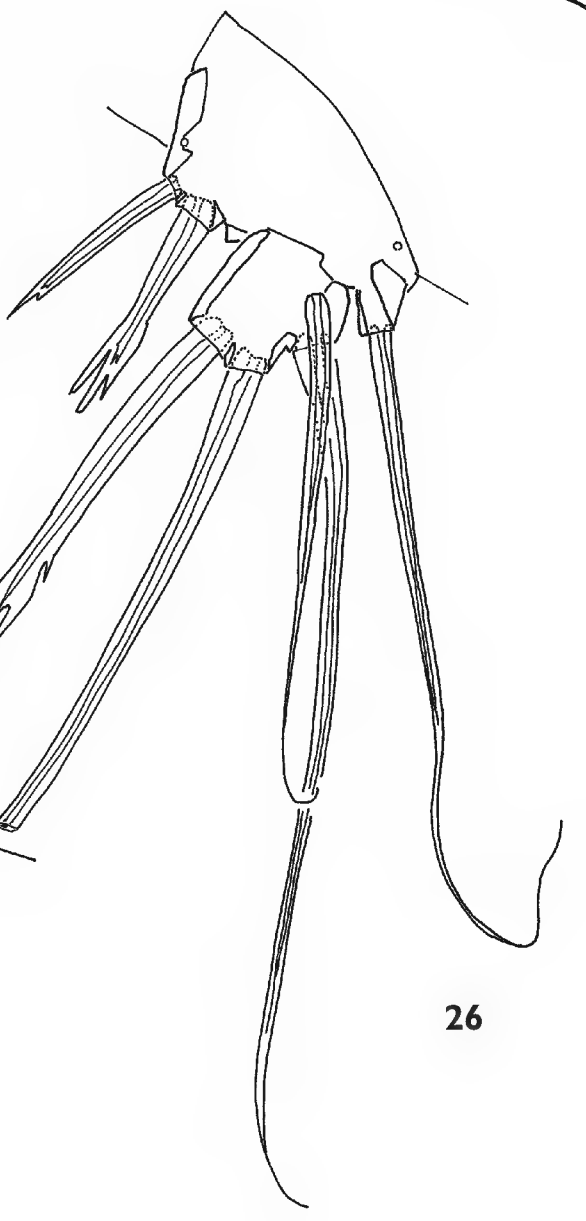




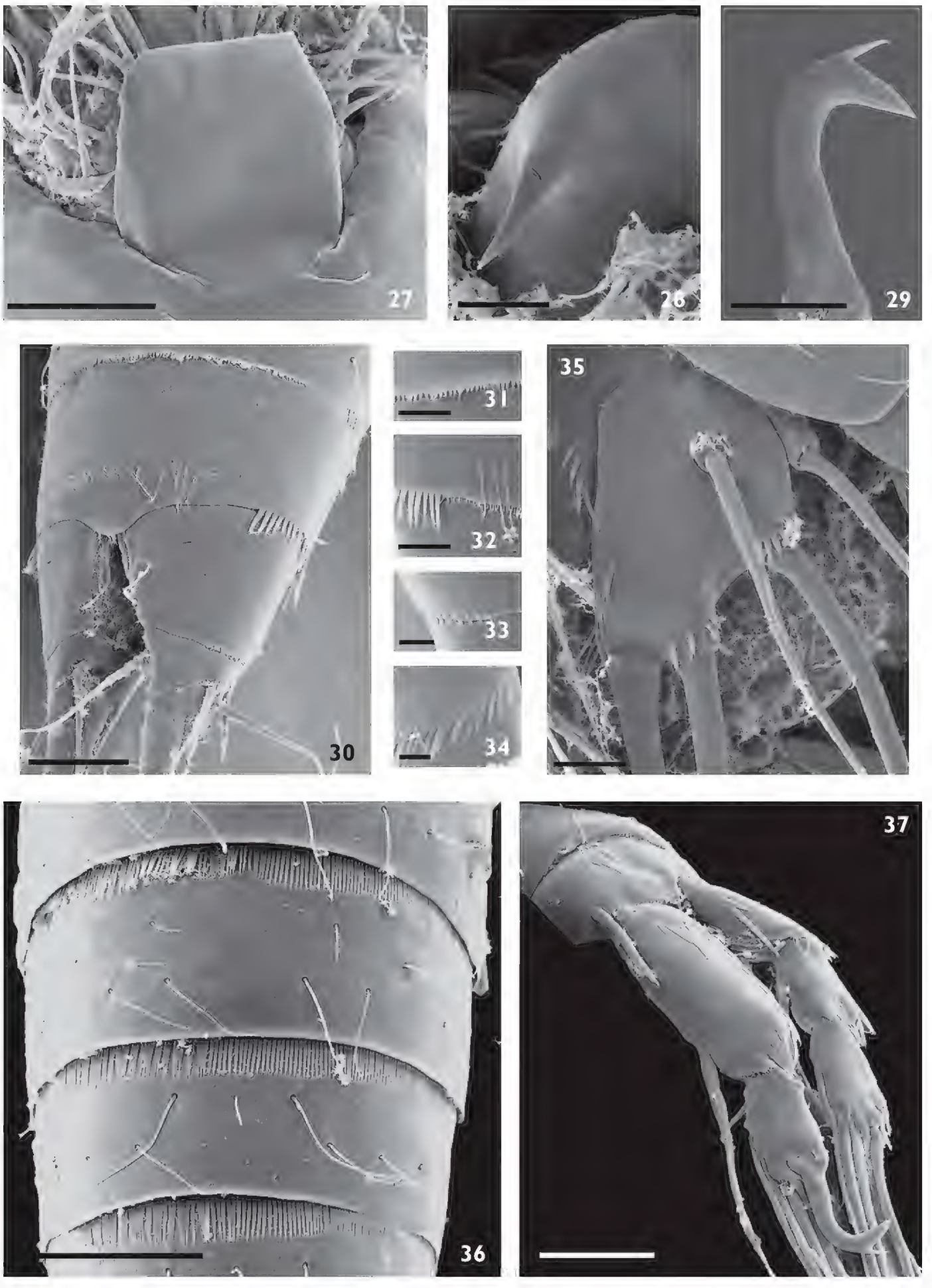
Figures 22-23. *Chaulionyx paivacarvalhoi* gen. et sp. n. ♂: **22** habitus, dorsal **23** urosome, ventral. Scale bars = 10 µm.







Figures 24-26. *Chaulionyx paivacarvalhoi* gen. et sp. n. ♂: **24** antennule, dorsal **25** P1 basis and endopod, anterior **26** P5, anterior. Scale bars = 10 μm.



Figures 27-37. *Chaulionyx paivacarvalhoi* gen. et sp. n. Scanning electron micrographs (♀: **27-35**; ♂: **36-37**): **27** rostrum, dorsal **28** labrum, anterior **29** bifid outer spine on P1 enp-2 **30** second abdominal somite (posterior margin), third abdominal somite, anal somite and caudal rami, dorsolateral **31** detail of serrate posterior margin of second abdominal somite **32** detail of posterior margin of third abdominal somite **33** posterior margin of anal somite **34** posterior margin of caudal ramus showing dorsal semi-circular serrate extension **35** P5, anterior **36** prosomal ornamentation, dorsal **37** P1 endopod, anterior. Scale bars: 1 µm (**34**), 2.5 µm (**33**), 5 µm (**28-29**, **31-32**, **35**), 10 µm 27 (**30**, **37**), 20 µm (**36**).

MALE. (Figs 22-26, 36-37). Body length 230-260 µm (n = 6; mean = 246 µm) (Fig. 22). Sexual dimorphism expressed in caudal ramus, antennule, P1, P5, P6, and in genital segmentation. Ornamentation of body (Figs 22-23, 36) generally as in female, except for small differences such as cephalic sensilla being longer and distributed differently, and pits, pores and chitin patches missing on the cephalic shield.

Caudal ramus (Fig. 23) with both dorsal and ventral posterior margin produced into triangular extension covering bases of setae IV–VI.

Antennule (Fig. 24), haplocer, 7-segmented; geniculation between segments 5 and 6; segment 5 elongated and incompletely divided. Setae and aesthetasc formula: 1-[1], 2-[7], 3-[3], 4-[1], 5-[7 + ae], 6-[0], 7-[1 + ae].

P1 (Figs 25, 37). Enp-2 wider than in female; outer distal spine with bifid apex.

P5 (Figs 23, 26) shorter than in female. Endopodal lobe small, with 2 short, stout setae, innermost with bifid apex, outer one with tridentate apex. Exopod short; with 1 seta on anterior surface and 3 marginal setae; inner distal seta with tridentate apex, outer distal seta very long.

P6 (Fig. 23) asymmetrical, without ornamentation.

Etymology. The new species is named in honour of Prof. João de Paiva Carvalho (Instituto Oceanográfico, Universidade de São Paulo) in recognition of his significant contributions to the taxonomy of Copepoda.

Discussion

The form of the maxilla is of high significance in assessing phylogenetic relationships within the family Ectinosomatidae. Two types can be distinguished on the basis of the shape and orientation of the allobasis. In the first type the maxilla is stenopodial (non-prehensile) with the syncoxa, allobasis and endopod arranged in a virtually rectilinear sequence. This arrangement is displayed in *Ectinosoma*, *Halectinosoma*, *Rangabradya*, *Microsetella* and the interstitial genera *Arenosetella*, *Glabrotelson*, *Microsetella*, *Ectinosomoides* and *Oikopus*. In the second type the syncoxa and allobasis are directed at a right angle, forming a prehensile limb. The articulation between these two segments is modified and typically displays a large membranous area around the medial distal surface of the syncoxa, facilitating flexure of the distal part of the maxilla. This prehensile type is found in all other ectinosomatid genera, including *Chaulionyx,* gen. n. Within this group (and the entire family) only three genera – in addition to *Chaulionyx* – display a prehensile P1 endopod: *Halophytophilus* Brian, 1919, *Bradyellopsis* Brian, 1925 and *Klieosoma* Hicks & Schriever 1985. Among this group, the primitive genus *Klieosoma* can be readily distinguished by the ancestral 3-segmented condition of the P1 endopod, bearing 4 (*K. spinosa* Hicks & Schriever, 1983) or 5 elements (*K. triarticulatus* (Klie, 1949)) on the distal segment, unlike the 2-segmented condition consistently reported for the other three genera. *Chaulionyx* differs from the remaining two genera in the presence of a conspicuous bifid claw (in addition to 5 well developed plumose setae) on the distal endopod segment of P1, the presence of distinctive subrectangular

middorsal pores on the urosomites (similar pores have thus far only been reported for *Ectinosoma*; cf. Huys and Bodin 1997) and the unarmed sixth legs in the male (in both *Bradyellopsis* and *Halophytophilus* the male P6 bears 1 seta). Descriptions of all species of *Bradyellopsis* (except *B. foliatus* Watkins, 1987) are incomplete (Wells 2007) but differ from *C. paivacarvalhoi* in the presence of a large spine (or spinous process) on segment 2 (and often segments 1 and 3) of the antennule, the rudimentary antennary exopod (at most a small segment with 1-3 setae), the spinous projections on the caudal rami and the detailed morphology of P1 enp-2. Species belonging to *Halophytophilus* can be distinguished from *C. paivacarvalhoi* by the presence of 3 outer spines on P1–P4 exp-3 but only 3 elements on P1 enp-2.

On the distinction between *Noodtiella* and *Lineosoma*

Wells (1965) proposed two new genera for interstitial ectinosomatids from the Canary Islands and Portugal, and England, respectively: *Noodtiella* Wells, 1965 (type species by original designation: *Sigmatidium* ? *arenosetelloides* Noodt, 1958) and *Lineosoma* Wells, 1965 (type species by original designation: *Lineosoma iscense* Wells, 1965; since the gender of the genus is neuter the incorrect original spelling *iscensis* is amended here accordingly, cf. ICZN Art. 30.1.2). Both *Noodtiella* Wells, 1965 and *Noodtia* Lang, 1965 have the same name-bearing type, *S.* ? *arenosetelloides* Noodt, 1958, and are therefore objective synonyms. The former takes precedence over the latter [see postscript in Lang (1965: 547)]. Wells (1965) remarked on the close similarity between *Noodtiella* and *Lineosoma* (e.g. in body shape, antennule, antenna, prehensile maxilla, P5) but considered the 2-segmented condition of the P1–P4 endopods in the former (as opposed to 3-segmented in *Lineosoma*) sufficient justification for the separation into two genera.

Wells' (1967) description of *N. intermedia* rendered the distinction between *Noodtiella* and *Lineosoma* no longer tenable since his species displayed a 2-segmented P1 endopod but 3-segmented P2–P4 endopods. According to the author the segmentation pattern in *N. intermedia* can so readily be interpreted as intermediate between the two known conditions that, collectively, the species included in *Noodtiella* and *Lineosoma* form an evolutionary sequence. Consequently, Wells (1967) synonymised both genera, stating that *Noodtiella* Wells, 1965 (p. 30) has page priority over *Lineosoma* Wells, 1965 (p. 33) and the latter must sink as a junior subjective synonym of the former. This course of action was followed by Lindgren (1975) who added *N. enertha* (another species with 3-segmented P1–P4 endopods) to the genus.

Using the widely accepted distinction between *Sigmatidium* (P2–P4 endopods 3-segmented) and *Pseudectinosoma* (P2–P4 endopods 2-segmented) as an analogy, Kunz (1975) believed the separation on the same grounds between *Noodtiella* and *Lineosoma* was warranted and reinstated the latter as a valid genus (in which he included *N. intermedia*). However, the subsequent description of *N. gracile* Mielke, 1975, *N. frequentior* Mielke, 1979 and *N. mielkei* Wells & Rao, 1987 – all of which exhibit a

Table 2. Swimming leg armature formulae of the 18 valid *Noodtiella* species (P4-OS = outer spine of P4 exp-2 present/absent; P5-OS♀ = outer endopodal spine fused to baseoendopod in female/discrete at base). Segments with numerals in boldface refer to endopodal segments with posterior surface setae.

	P1		P2		P3		P4		P4-OS	P5-OS♀
	exp	enp	exp	enp	exp	enp	exp	enp		
N. iscensis (Wells, 1965), comb. n. [a]	0.0.021	1.1.120	1.1.021	1.1.120	1.1.021	1.1.221	1.1.021	1.1.221	?	discrete
N. enertha Lindgren, 1975 [b]	0.1.021	1.0.221	1.1.021	1.0.**3**21	1.1.021	1.0.**3**21	1.1.021	1.0.**3**21	+	fused
N. intermedia Wells, 1967 [c]	0.1.022	1.121	1.1.022	1.1.121	1.1.022	1.1.121	1.1.022	1.1.121	?	fused
N. chilensis (Mielke, 1987a), comb. n.	0.1.022	1.120	1.1.022	1.0.**2**20	1.1.022	1.0.**2**20	1.1.022	1.0.**2**20	+	discrete
N. pectinata (Chappuis, 1954a), comb. n. [d]	0.1.022	1.121	1.1.022	1.**3**21	1.1.022	1.**3**21	1.1.021	1.**3**21	+	fused
N. wellsi Apostolov, 1974	0.1.022	1.121	1.1.022	1.221	1.1.022	1.221	1.1.022	1.221	+	discrete
N. ornamentalis Wells & Rao, 1987 [e]	0.1.022	1.121	1.1.022	1.221	1.1.022	1.221	1.1.022	1.221	?	fused
N. lusitanica Wells, 1965 [f]	0.1.021	1.121	1.1.021	1.221	0.1.021	1.221	0.1.021	1.221	?	fused
N. arenosetelloides (Noodt, 1958)	0.1.022	1.121	1.1.022	1.121	1.1.022	1.121	1.1.022	1.121	+	discrete
N. hoodensis Mielke, 1979	0.1.022	1.120	1.1.021	1.**2**20	1.1.021	1.**2**20	1.1.021	1.**2**20	–	discrete
N. tabogensis Mielke, 1981	0.1.022	1.120	1.1.021	1.**2**20	1.1.021	1.**2**20	1.0.021	1.**2**20	–	discrete
N. coquimbensis Mielke, 1987b	0.1.022	1.120	1.1.021	1.**2**20	1.1.021	1.**2**20	1.1.021	1.**2**20	+	discrete
N. larinconadensis Mielke, 1987b	0.1.022	1.120	1.1.021	1.**2**20	1.1.021	1.**2**20	0.1.021	1.**2**20	–	discrete
N. pacifica Mielke, 1987b	0.1.022	1.120	0.1.021	1.**2**20	0.1.021	1.**2**20	1.1.021	1.**2**20	–	discrete
N. problematica (Rouch, 1962) [g]	0.1.022	1.120	0.1.021	1.120	0.1.021	1.**2**20	0.1.021	1.**2**20	–	discrete
N. frequentior Mielke, 1979	0.0.022	1.120	1.0.021	1.**2**20	1.0.021	1.**2**20	1.021	1.**2**20	–	discrete
N. mielkei Wells & Rao, 1987	0.1.022	1.120	1.1.022	1.**2**20	1.1.022	1.**2**20	1.122	1.120	+	fused
N. gracile Mielke, 1975	0.1.021	1.120	1.1.021	1.**2**20	1.1.021	1.**2**20	1.121	1.120	–	discrete

[a] Based on Huys et al. (1996). This species was originally described as *Pararenosetella* sp. by Wells (1963).

[b] Lindgren (1975) claimed this species is unique by the presence of two inner setae on P2–P4 enp-1; this is undoubtedly an observational error resulting from misinterpreting the setular tuft for a supernumerary seta. In addition, the author stated correctly that P2–P4 enp-2 has 6 setae but this is not reflected in his setal formula which gives 221 for these segments. Finally, his illustration of P1 showing no seta on enp-2 but a 221 armature pattern on enp-3 requires confirmation since it conflicts with the pattern observed in *N. iscensis* (a 1.1.121 formula for P1 endopod would be more likely).

[c] Wells (1967) showed an outer distal spine on P1 enp-2 but this is likely to be the distal portion of the artificially displaced inner seta. Wells and Rao (1987) pointed out that the original description is wrong in that P1 enp-2 bears four elements, not three.

[d] Mitwally and Montagna (2001) list the formula for P2–P4 enp-2 as 221 but do not take into account the posterior surface seta; the formula is here amended to 321

[e] Wells and Rao's (1987) illustration of the P2 is likely to be incorrect; the distal endopod segment appears to be reversed although the spinule row marking the original subdivision is illustrated on the correct (outer) margin; given the close relationship to *N. pectinata* it is also conceivable that the authors overlooked the posterior surface seta on P2–P4 enp-2.

[f] The armature formula of P1 enp-2 is 121 according to Wells' (1965) Table I but the illustration of this appendage (his Fig. 9) shows 120 instead. Similarly, it appears that the P2 exopod is rotated 180 degrees in his Fig. 10 giving the false impression that there is no inner seta on enp-1.

[g] Rouch (1962) lists the posterior surface seta of enp-2 for P3–P4 in his setal formula (and figures it for the P4) but not for P2; this loss requires confirmation and should not be used as a character to differentiate *N. problematica* from *N. pacifica*. Mielke (1987b) also used the absence of the inner seta on P4 exp-1 in *N. problematica* as an additional difference but this seta is reduced in *N. pacifica* and may well have been overlooked in Rouch' (1962) original description. It is conceivable that *N. pacifica* and *N. problematica* are conspecific.

2-segmented P4 exopod – once again casts doubt on the validity of this generic distinction, and Mielke (1987a) pointed out that *Lineosoma* in Kunz's (1975) sense was not diagnosed by an autapomorphy. This effectively renders the genus a paraphyletic group with respect to the species currently included in *Noodtiella*. Consequently, *Lineosoma* is here relegated to a junior subjective synonym of *Noodtiella*, adopting Wells' (1967) argument of page priority.

Chappuis (1954a) described two new species of *Arenosetella*, *A. incerta* (P1–P4 with 3-segmented endopods) and *A. pectinata* (P1–P4 with 2-segmented endopods) and presented illustrations of a fifth copepodid stage which he named "*Arenosetella* spec. juv.". These three forms co-occurred in the intertidal zone of Canet-Plage, which – in the absence of any habitus drawings in Chappuis' descriptions – made Lang (1965) suggest that "*Arenosetella* spec. juv." and *A. pectinata* represented the fourth and fifth copepodids of *A. incerta*, respectively. Conversely, Noodt (1958) surmised that *Arenosetella pectinata* Chappuis, 1954a was a valid species that may be assigned to the genus *Ectinosomoides*. Bodin (1997) listed the new combination *Ectinosomoides pectinatus* (Chappuis, 1954a) as a *species incerta* but incorrectly stated that Lang (1965) agreed with Noodt's (1958) opinion. Wells (2007) effectively listed *A. pectinata* as a synonym of *A. incerta*, claiming that the juvenile status of the former is corroborated by the different lines of circumstantial evidence highlighted by Lang (1965) (smaller body size, 2-segmented P2–P4 endopods with vestigial segment boundaries between enp-2 and enp-3) and Wells and Rao (1987) (juvenile condition of anal ornamentation). Copepodid V stages of *Arenosetella* lack the pseudoperculum and prominent anal hooks expressed in the adults but possess instead an arcuate anal operculum which bears a series of spinular extensions (Noodt 1952; Lang 1965; Wells and Rao 1987). This condition is also found in "*Arenosetella* spec. juv." and appears to reinforce Chappuis' (1954a) claim that this stage represents the last copepodid of *A. incerta*, however, it is radically different from that displayed in *A. pectinata*. Chappuis (1954a), in his description of the latter, stated "…, à la place de l'opercule anal, deux plaques symétriques se terminant chacune en 5 à 6 pointes". A similar raised pair of multidentate lamellae on the anal somite was described for two closely related species in the genus *Noodtiella*: *N. ornamentalis* Wells & Rao, 1987 and *N. toukae* Mitwally & Montagna, 2001. Based on this character and the apparent differences with *Arenosetella*, Wells and Rao (1987) suggested that *N. ornamentalis* may be placed in a genus separate from *Noodtiella* but refrained from formally naming and diagnosing it. However, *N. ornamentalis* displays all the diagnostic characters of *Noodtiella* and has exactly the same swimming leg setal formula as *N. wellsi* Apostolov, 1974, which lacks the multidentate lamellae (Table 2). Since removing this species, and the closely related *N. pectinata*/*N. toukae*, would render *Noodtiella* a paraphyletic taxon, they are here retained in the genus as representatives of a specialized lineage characterized by the conspicuous anal ornamentation. Mitwally and Montagna (2001) compared *N. toukae* with *N. ornamentalis* but naturally not with *A. pectinata*. Comparison with Chappuis' (1954a) description reveals complete congruence in the morphology of the swimming legs, fifth legs of both sexes and the anal somite between both Mediterranean forms. Consequently, *A. pectinata* is here removed from its uncertain position in *Ectino-*

somoides to the genus *Noodtiella* as *N. pectinata* comb. n., and *N. toukae* is relegated to a junior subjective synonym of the latter.

A dichotomous key to the 18 valid species of *Noodtiella* is presented below. Swimming leg setal formulae for these species are compiled in Table 2.

1	P1 endopod 2-segmented **2**
–	P1 endopod 3-segmented **12**
2	P2–P4 endopod 2-segmented **3**
–	P2–P4 endopod 3-segmented **13**
3	P4 exopod 2-segmented **4**
–	P4 exopod 3-segmented **6**
4	P2–P3 exp-3 with 4 setae/spines; P4 exp-2 with 5 setae/spines ..... ***mielkei***
–	P2–P3 exp-3 with 5 setae/spines; P4 exp-2 with 3 or 4 setae/spines **5**
5	P1 exp-2 with inner seta; P1 exp-3 with 3 elements; P3 exp-2 with inner seta; P4 exp-2 with 4 setae/spines ..... ***gracile***
–	P1 exp-2 without inner seta; P1 exp-3 with 4 elements; P3 exp-2 without inner seta; P4 exp-2 with 3 setae/spines ..... ***frequentior***
6	P1 enp-2 with 3 elements 7
–	P1 enp-2 with 4 elements **14**
7	P4 exp-2 with outer spine ..... ***coquimbensis***
–	P4 exp-2 without outer spine **8**
8	P2–P3 exp-1 without inner seta **9**
–	P2–P3 exp-1 with inner seta **10**
9	P4 exp-1 with short inner seta ..... ***pacifica***
–	P4 exp-1 without inner seta ..... ***problematica***
10	P4 exp-1 with inner seta **11**
–	P4 exp-1 without inner seta ..... ***larinconadensis***
11	P4 exp-2 with inner seta; P5 exopod with 3 setae in female and 4 setae in male ..... ***hoodensis***
–	P4 exp-2 without inner seta; P5 exopod with 2 setae in female and 3 setae in male ..... ***tabogensis***
12	P1 exp-2 with inner seta; female P5 with outer endopodal spine fused to baseoendopod ..... ***enertha***
–	P1 exp-2 without inner seta; female P5 with outer endopodal spine not fused to baseoendopod ..... ***iscensis***
13	P1 enp-2 with 4 elements; P4 enp-2 with inner seta; female P5 with outer endopodal spine fused to baseoendopod ..... ***intermedia***
–	P1 enp-2 with 3 elements; P4 enp-2 without inner seta; female P5 with outer endopodal spine not fused to baseoendopod ..... ***chilensis***
14	P1–P4 exp-3 with 3 elements ..... ***lusitanica***
–	P1–P4 exp-3 with 4 elements **15**
15	P2–P4 enp-2 with 4 elements; P4 exp-3 with 4 elements ..... ***arenosetelloides***
–	P2–P4 enp-2 with 5 elements; P4 exp-3 with 4 elements **16**

–	P2–P4 enp-2 with 6 elements; P4 exp-3 with 3 elements.....***pectinata***
16	Anal somite without paired multidentate lamellae; female P5 with outer endopodal spine not fused to baseoendopod.....***wellsi***
–	Anal somite with paired multidentate lamellae; female P5 with outer endopodal spine fused to baseoendopod..... ***ornamentalis***

Key to the Genera of Ectinosomatidae

The genus *Tetanopsis* Brady, 1910 (type species: *T. typicus*) is included in the key below based on its allegedly 1-segmented antennary exopod, however, it should be recognized that its status is currently doubtful (Huys et al. 1996; Wells 2007) as well as the grounds for subsequently allocating *T. medius* Perkins, 1956, *T. smithi* Perkins, 1956 and *Arenosetella mediterranea* Chappuis, 1954b to this genus (Perkins 1956; Lang 1965).

The antennary exopod of *Ectinosomoides* was claimed to be entirely absent (Nicholls 1945) and this character was adopted by Wells (2007: 381) in his tabular keys. Huys et al. (1996: 158) scored the exopod as 3-segmented in their dichotomous key and this condition has been confirmed by re-examination of the single female of *E. longipes* Nicholls, 1945 found among the type material of *Neoleptastacus spinicaudatus* Nicholls, 1945 (cf. Sak et al. 2008: 435).

Nicholls (1935) established the genus *Hastigerella* for a new species *Hastigerella palpilabra* Nicholls, 1935 but McLachlan and Moore (1978: 198) relegated it to a junior synonym of *Ectinosoma tenuissima* Klie, 1929 and – based on their assertion that Nicholls (1935) had overlooked the anal claws – transferred this species to *Arenosetella*. They retained *Hastigerella* as a valid generic name and illegitimately designated *Ectinosoma leptoderma* Klie, 1929 as the new type species (ICZN Art. 61.1.3). Huys (2009) pointed out that adopting McLachlan and Moore's (1978) synonymy of *H. palpilabra* would render *Hastigerella* a junior subjective synonym of *Arenosetella* and therefore an invalid name. He proposed a new name, *Glabrotelson* (type species: *Hastigerella mehuinensis* Mielke, 1986), for the orphaned taxonomic grouping equivalent to *Hastigerella sensu* McLachlan and Moore (1978).

Seifried et al.'s (2007) course of action to upgrade the subgenus *Bradya* (*Parabradya*) to full generic rank appears premature since this leaves *Bradya* (now equivalent to its nominotypical subgenus) with only one questionable autapomorphy and hence a potentially paraphyletic status. The authors considered the maxillipedal endopod being fused to the basis at an angle as sufficient evidence to warrant separate generic status for the nominotypical subgenus *Bradya*. However, as the authors admitted themselves the fusion is not complete in some as yet undescribed *Bradya* species. Both *Bradya* and *Parabradya* are retained here as valid genera but an in-depth study of all species accommodated in the former genus is required before the validity of this separation can be confirmed. Lang (1936) showed 5 setae on the exopodal lobe of the female P5 in *Parabradya confluens* (Lang, 1936). This is a very unusual condition not found in any other extant member of the Ectinosomatidae (see also

Seifried et al. 2007) and would require re-examination of the type material before it can be used for identification.

As has been pointed out by Karanovic and Pesce (2001), Vervoort (1962: 399) explicitly fixed *Ectinosoma sarsii* Boeck, 1873 as type species of the subgenus *Ectinosoma* (*Halectinosoma*) but Lang (1965: 11), who upgraded *Halectinosoma* to generic status, did not mention Vervoort's (1962) designation. A comparison of the diagnoses of the two subgenera given in Lang (1944: 6) shows that *Halectinosoma* is distinguished from *Ectinosoma* on the basis of the setation of the exopod of leg 5. Therefore, the generic name *Halectinosoma* is available from Vervoort (1962), who cited (p. 255) that page in Lang (1944) in this connection and designated a type species (Huys 2008, 2009).

Wells and Rao (1987) placed their new species *Halophytophilus aberrans* with some diffidence in the genus *Halophytophilus* because it showed significant differences with its congeners in the non-prehensile P1 endopod and the armature of the P2–P4 endopods, in addition to discrepancies in the accessory ornamentation of the swimming legs and abdomen, and in the P5 and the caudal rami. The authors believed that there was a case for proposing a new subgenus for this species while Huys et al. (1996) surmised that it may belong to a separate genus. Bodin (1997) and Wells (2007) placed *H. aberrans* in the genus *Klieosoma* without giving any factual justification for this course of action. Gheerardyn et al. (2008) did not consider the species in their review of the genus *Halophytophilus*. It has now come to our attention that Wells and Rao's (1987) setal formula of P4 contradicts their illustration. In their description the authors stated that P2–P4 exp-1 lacks an inner seta while their Fig. 28f clearly shows a well developed seta on this segment in leg 4. Huys et al. (1996) constructed their generic key on the assumption that this seta was absent in all swimming legs and hence *H. aberrans* may have keyed out to the wrong couplet. Without any illustrations of the maxilla (although Wells and Rao did state that the mouthparts were as in *H. simplex* Wells & Rao, 1987) and P2–P4 it is impossible to decide which genus *H. aberrans* belongs to and, consequently, it is here considered *species incertae sedis* in the Ectinosomatidae. A dichotomous key to the 21 valid genera in the Ectinosomatidae is given below.

1	Body cylindrical with cephalothorax rectangular in dorsal aspect; body approximately the same width throughout its length **2**
–	Body fusiform with cephalothorax sub-triangular in dorsal aspect; greatest body width usually at posterior margin of cephalothorax; urosome gradually tapering towards the posterior end **8**
–	Body with dorsoventrally depressed prosome, clearly wider than urosome .... ***Peltobradya*** **Médioni & Soyer, 1968**
2	Antennary exopod 2-segmented; maxilla prehensile, with major articulation between elongate syncoxa and elongate allobasis ..... ***Noodtiella*** **Wells, 1965**
–	Antennary exopod 1- or 3-segmented; maxilla not prehensile, with at most a slight angle between syncoxa and allobasis **3**
3	Endopods P2–P4 2-segmented ..... ***Ectinosomoides*** **Nicholls, 1945**
–	Endopods P2–P4 3-segmented **4**

4 Anal somite with dorsal armature of claws, lappets or spiniform processes around anal opening; P5 exopod with 3 marginal and 1 surface seta ..... ***Arenosetella*** **Wilson, 1932**

– Anal somite without such ornamentation **5**

5 Antennary exopod 1-segmented..... ***Tetanopsis*** **Brady, 1910**

– Antennary exopod 3-segmented..... **6**

6 Female P5 with foliaceous setae on exopod and baseoendopod, exopod with 3 marginal and no surface setae; male P5 exopod with 4 normal marginal setae..... ***Oikopus*** **Wells, 1967**

– P5 with normal setae on exopod and baseoendopod in both sexes, exopod with 3 marginal and typically a surface seta [absent in *Hastigerella noodti* Soyer, 1974 = *G. soyeri* (Bodin, 1976)]..... ***Glabrotelson*** **Huys, 2009**

7 P1–P4 endopods 2-segmented..... ***Pseudectinosoma*** **Kunz, 1935**

– P1 endopod 2- or 3-segmented, P2–P4 endopods 3-segmented..... **8**

8 P1 endopod prehensile..... **9**

– P1 endopod not prehensile **12**

9 P1 endopod 2-segmented **10**

– P1 endopod 3-segmented ..... ***Klieosoma*** **Hicks & Schriever, 1985**

10 P1–P2 exp-3 with 2 outer elements **11**

– P1–P2 exp-3 with 3 outer elements ..... ***Halophytophilus*** **Brian, 1919**

11 Antennule with large spine on segment 2 (and often segments 1 and 3); antennary exopod rudimentary, with 1-3 small setae; P1 enp-2 with 4 elements (1-2 pinnate and claw-like) ..... ***Bradyellopsis*** **Brian, 1925**

– Armature elements on antennulary segments 1-3 setiform; antennary exopod well developed and 3-segmented; P1 enp-2 with 6 elements (outer one bifid and claw-like) ..... ***Chaulionyx*** **gen. n.**

12 Maxilla prehensile, with syncoxa and allobasis forming right angle; P5 exopod poorly developed, short, fused to baseoendopod in female and distinct in male, with 3 marginal and no surface setae; body very small (< 300 µm) ..... ***Sigmatidium*** **Giesbrecht, 1881**

– These characters not combined **13**

13 P5 exopod and baseoendopod fused, forming a single plate in both sexes **14**

– P5 exopod and baseoendopod at least partly discrete **15**

14 P1–P4 exp-3 with 5, 6, 6, 6 elements, respectively; male P6 unarmed; body of female small (< 400 µm); continental groundwater..... ***Rangabradya*** **Karanovic & Pesce, 2001**

– P1–P4 exp-3 with 6, 7, 8, 8 elements, respectively; male P6 with 2 setae; body of female large (≥ 1200 µm); marine, usually deepwater..... ***Parabradya*** **Lang, 1944**

15 Integument of somites with distinctive subrectangular pores; P5 exopod with 4 marginal setae ..... ***Ectinosoma*** **Boeck, 1865**

– Integument of somites without distinctive subrectangular pores; P5 exopod with 3 marginal setae and 1 seta on anterior surface.....**16**

16 Mandible with rudimentary gnathobase, elongate basis and filiform rami, each terminating in 2-3 setae; antennary exopod without lateral spines..... ..... ***Ectinosomella*** **Sars, 1910**

– These characters not combined **17**

17 Third segment of female antennule 3 times as long as wide; mandibular endopod with one strong seta laterally; P1–P4 exp-3 with 2 outer spines; planktonic (occasionally in sediment).....***Microsetella*** **Brady & Robertson, 1873**

– These characters not combined **18**

18 Body comparatively robust with prosome-urosome separation usually distinct (exception: *B. kurtschminkei* Seifried & Martínez Arbizu, 2008 with dorsoventrally flattened habitus); antenna with 2 setae on proximal exopod segment and 1 seta on proximal endopod segment; mandibular exopod with at least 5 setae; maxilliped robust with short endopod usually fused at an angle with basis and bearing 4 conspicuous setae .....***Bradya*** **Boeck, 1973**

– Body comparatively slender with no sharp separation between prosome and urosome; antenna with less than 2 setae on proximal exopod segment (except *Pseudobradya ambigua* Sars, 1920 with 2) and no seta on proximal endopod segment; mandibular exopod generally with fewer than 5 setae; maxilliped usually slender and straight with discrete endopod bearing 1 small and 4 conspicuous setae.....**19**

19 Antennule with or without dark pigment spot within the proximal three segments; maxilla prehensile, allobasis usually truncate distally and carrying 3-segmented endopod (although endopod sometimes very small and segmentation difficult to discern; reduced to a a narrow 3-segmented cylinder in *P. leptognatha* Sars, 1920); maxilliped short and robust..... ..... ***Pseudobradya*** **Sars, 1904**

– Antennule without pigment spot; maxilla with at most a slight angle between syncoxa and allobasis, the latter generally attenuating distally, endopod 3-segmented but always small, its morphology not clearly discernible; maxilliped generally slender .....***Halectinosoma*** **Vervoort, 1962**

Acknowledgements

The authors would like to thank Dr Thais Corbisier (Departamento de Oceanografia Biológica, Instituto Oceanográfico – IOUSP), for putting the material at our disposal. Prof. John B. J. Wells (University of Wellington) is gratefully acknowledged for his critical review of an earlier draft of the manuscript. One of us (TCK) acknowledges financial support from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Programa BIOTA/FAPESP – Bentos Marinho (Proc. 1998/07090-3) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES (Proc. BEX 4159/07-1).

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